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(54) PLANT FOR THE HORIZONTAL PAINTING OF SHAPED DOORS

(57) Method for the horizontal, wet on wet painting of objects (3) having two prevailing sides, wherein the painting of the first side and the painting of the second side are performed inside two distinct painting stations (2 ,6),
characterized by the following steps:
a) Inserting an object (3) to be painted inside a frame (5);
b) The assembly of object (3) and frame (5) is conveyed inside a first painting station (2) so that said object (3) is horizontally painted on its top prevailing side;
c) The assembly of object (3) and frame (5) is conveyed from the first painting station (2) to an overturning device (4) so that the object (3) never touches said conveying means;
d) The assembly of object (3) and frame (5) is turned of 180° inside the overturning device (4);
e) The assembly of object (3) and frame (5) is conveyed to the second painting station (6) so that the object (3) never touches said conveying means;
f) The second prevailing side of the object (3), turned upwards, is horizontally painted inside the second painting station (6).

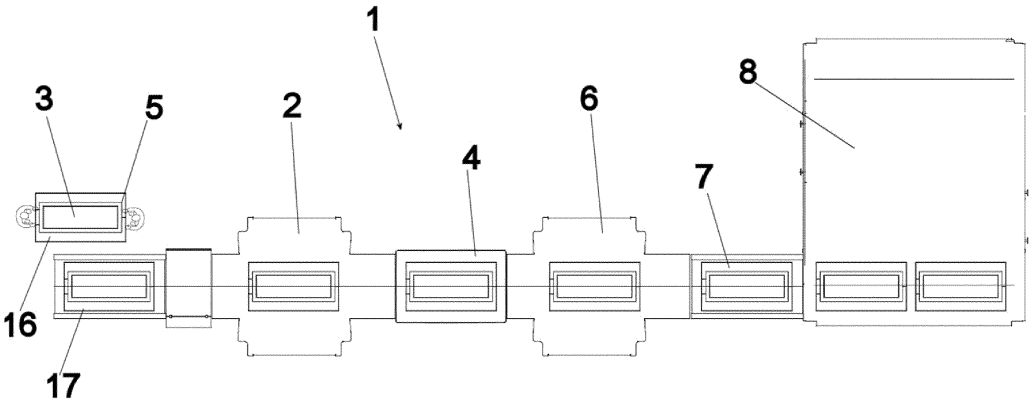

FIG. 1

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Description

[0001] The present invention relates to the technical field of plants for applying paint on products having prevailing flat surfaces, like in particular doors. In particular, the present invention relates to the painting of shaped doors, i.e. doors having raised/shaped parts, on both the prevailing sides of the door.

[0002] Painting doors on both their prevailing sides is known in the art. In principle, two different method can be used:

- Painting the first prevailing side of the door, drying the first side, later on painting the second prevailing side of the door, and drying the second side;
- Painting the first prevailing side of the door, painting the second prevailing side of the door while the coating layer on the first side is still wet and later on drying the whole door in a unique step.

[0003] In the first case, manufacturing takes longer, and there is the risk that the paint applied on the second side damages the already finished first side. In the second case, the door must be supported so that none of the four main sides, covered with wet paint, comes into contact with other surfaces, undergoing a damage.

[0004] For reasons linked to plant economy and ease of manufacturing, the second solution is preferred. The technical problem, in this case, becomes providing a method and a device for overturning the door, such that no point of the door covered with wet paint comes into contact with something able to cause damages before that wet paint is dried and therefore stabilized.

[0005] The present invention seeks to provide a method and an apparatus free from the above-mentioned drawbacks.

[0006] This object is achieved by a method having the features of the independent claim. Advantageous embodiments and refinements are specified in claims dependent thereon.

[0007] The present invention consists in a painting method of a first side of the door, during which said door is kept horizontal, keeping it suspended through a frame, using the frame itself as a conveying means of the door itself through the plant. The assembly of frame and door is overturned, and door's second side is painted; the door painted on its two prevailing sides without drying the first coated side before painting the other side is later on dried through a unique passage in an oven.

[0008] The advantages of the present invention are manifold. A first advantage is linked to the implementation simplicity of the production line. A second advantage is the high productivity of the line, which is proportional to the speed of the painting process. A third advantage is that, using suitable painting stations, the overspray deposition on the conveying system of the painting station can be recovered. This makes the production line economically advantageous also in its management. A fourth advantage is that the production line according to the present invention is particularly versatile, in that it can be used to paint any type of product having prevailing flat surfaces, like furniture doors, tables, door frames. In fact, the present invention allows to use normal production lines for painting prevailing flat products to paint a product which is special like a shaped door, without modifications to the basic production line, simply using a supporting frame for the door to be painted.

[0009] In the present invention the term prevailing sides of an object defines in the case of a door or panel shaped object the sides having the bigger area relatively to the area of the head sides of the door or of a panel-shaped object extending transversely to the prevailing sides.

[0010] The frame comprises at least four members, of which two side members and two transverse members that are connected together so to forma an empty inner space delimited by the said frame members and inside which the object has to be removably secured to the frame. In a preferred embodiment, but not necessarily, the shape defined by the frame is similar to the one of the perimeter of the object but larger so that the frame member can be kept at a distance from the corresponding head sides of the door or panel like object. In this case, the frame members may be parallel to the head sides of the door or panel-like object extending along the height of the said door or panel like object.

[0011] Securing the frame to the object in a removably way determines that the object may be separated from the frame, but when the object is secured to the frame the two parts are not allowed to be displaced one with respect to the other in any direction neither by rotation nor by translation.

[0012] In first instance the advantages of the invention are achieved by the method according to claim 1 in which the object is kept with the prevailing sides horizontal during painting of the first and of the second sides and by supporting the prevailing side not oriented upwards, as the one facing the conveyor resting surface at a distance from the said resting surface.

[0013] Since when overturning the coating layer on the first painted surface is still not dry, according to a further improvement of the invention the overturning is performed in a housing insulated from the environment and in which forced air is circulated.

[0014] Further advantages and properties of the present invention are disclosed in the following description, in which exemplary embodiments of the present invention are explained in detail on the basis of the drawings:

Figure 1 Top view of a painting plant according to the present invention;
Figure 2 Prospective view of the frame;
Figure 3 Magnification of a detail of the frame in a prospective view;
Figure 4 Transversal section of the frame-door as-

sembly.

[0015] Figure 1 shows a top view of the painting plant 1 according to the present invention. Said plant comprises a first painting station 2, inside which a door 3 is painted on its upward side, while said door is kept parallel to the ground. During the painting process, the door forms an assembly with a frame 5 that supports said door, as will be better clarified in the following.

[0016] Said door 3 comes out from the painting station 2 while the just applied paint is still wet, and is conveyed to an overturning device 4, which allows to overturn the door so that the just painted, and still wet, side faces the ground. The frame 5 supporting the door 3 is designed so that no portion of the door 3 can ever come into contact with the door conveying system.

[0017] Overturning devices are well known in the art, and will not be described in detail. These devices can have a construction dedicated to the specific conditions, or can be suitably programmed robotic devices, like e.g. a robotic arm or similar devices. We only mention that the door 3 travels along the production line 1 with its longitudinal axis parallel to the motion direction along production line 1. The overturning of the door is performed turning the door of 180° around its longitudinal axis A.

[0018] Now the door 3 is conveyed towards the second painting station 6, wherein its second prevailing side, always upwards, is painted.

[0019] Now a further conveyor 7 conveys the door 3, always supported by frame 5, inside an oven 8, which dries the wholly painted door.

[0020] In the preferred embodiment, the two painting stations 2, 6 are in the form of oscillating spraying stations. To the skilled person is nonetheless obvious that this is only one of the many forms wherein a painting station can be realized; e.g., doors can also be manually painted with a sprayer, o painted using also an anthropomorphic robot or a five-axis robot, or the like.

[0021] As shown in Figure 2, the frame 5 has a four-sided shape, of dimensions wider than those of door 3. The frame 5 is made so that pivots 9, 10, 11, stuck in the short (top and bottom) sides of the door, support the door 3. Said pivots form the connection between door 3 and frame 5; in particular, a pivot 9 fixes the door to the short side 14 of the frame 5, while two pivots 10, 11 fix the door to the short side of frame 5.

[0022] As better appreciable in the magnification of Figure 3, the long sides 12, 13 of the frame 5 have a height such that the protruding parts of the door 3 can never touch conveying means 20, e.g. a conveying band or a roller table or the like, in any point of the production line 1, while the frame 5 rests on the bearing surface of conveying means 20 with the bottom edges of the two longitudinal frame members 12, 13 of frame 5. The door and the transversal elements of frame 5, corresponding to the short sides 14 and 15 remain lifted from the support plane of the conveying means 20. In particular, the frame short sides 14, 15 have a height smaller than that of the long sides 12, 13, so hindering the contact between short sides 14, 15 and conveying means. This precaution hinders the contact of the frame short sides 14, 15 with the conveying systems after the painting stations, leading to possible damages of the painted door.

[0023] According a further feature, the door is positioned inside the frame 5 in correspondence of an intermediate plane of the height of the longitudinal members on the longitudinal sides 12, 13 of frame 5. Said plane is in a position, with respect to the height, such that the door is kept lifted from the supporting plane of the conveying means 20 in both its positions overturned of 180° around the central longitudinal axis of the door and/or of frame 5, being the thickness of the door smaller than said measure in height.

[0024] In the present embodiment, the measure of the height of the short sides 14, 15 of the frame 5 is smaller than the height measure of the longitudinal sides 12, 13; the above paragraph is valid for said short sides too.

[0025] As better appreciable in Figure 4, it is important that the thickness S of the long sides 12 and 13 is as small as possible, compatibly with the stability of the frame 5 itself. The thickness of the preferred embodiment is equal to some millimetres. This always with the aim to hinder the soiling of the conveying devices 4, 7 downstream the spraying stations.

[0026] Moreover, it is worth noting that the conveying devices 4 and 7, downstream spraying stations 2, 6, respectively, are critical points, because impurities, dirt particles etc. can easily adhere to wet paint. Due to this, for high-quality applications, the conveying devices 4 and 7 must be covered and insulated from the external environment.

[0027] In an embodiment specific for high-quality applications, the conveying and overturning device 4 is particularly critical, in that the rotation of the assembly door 3-frame 5 generates air whirls which might move dust particles present in the environment. The overturning device must be closed inside a closed room, which is forcedly supplied with filtered air. This hinders the soiling of the already painted, but not yet dried, parts.

[0028] To the skilled man it is known that upstream the painting line 1 there is provided a supplying and loading conveyor, on which the assembly of door 3 and frame 5, previously assembled, are loaded. Such loading can be manually performed, as shown in Figure 1, or automatically performed through an automatic loader.

[0029] Downstream said loading conveyor 16, and immediately upstream the first painting station 2, there is a cleaning device 17, which eliminates any processing residue or dirt particles or dust from the door 3 before the painting process starts. Performing the cleaning through brushes and compressed air is known.

[0030] Summarizing, the present method comprises the following steps:

a) Inserting an object 3 to be painted on its two prevailing sides inside a frame 5;

b) The assembly of object 3 and frame 5 is conveyed inside a first painting station 2 so that said object 3 is horizontally painted on its top prevailing side;
c) The assembly of object 3 and frame 5 is conveyed from the first painting station 2 to an overturning device 4 optionally supplied with filtered air;
d) The assembly of object 3 and frame 5 is turned of 180° inside the overturning device 4;
e) The assembly of object 3 and frame 5 is conveyed to the second painting station 6;
f) The second prevailing side, turned upwards, is horizontally painted inside the second painting station 6;
g) Optionally, the assembly of object 3 and frame 5 is conveyed to an oven 8 for drying all the paint applied on the door 3.

[0031] In a particularly advantageous embodiment, the two painting stations 2, 6 are realized with apparatuses capable of paint recovery; said apparatuses are already well known in the art. E.g. paint can be recovered using systems working on the conveying system; systems using reverse rollers or scrapers working on the conveying systems are known, also in combination with solvents.

1	Painting plant
2	First painting station
3	Door
4	Overturning device
5	Frame
6	Second painting station
7	Conveyor
8	Oven
9	Pivot
10	Pivot
11	Pivot
12	Frame long side
13	Frame long side
14	Frame short side
15	Frame short side
16	Loading conveyor
17	Cleaning device

Claims

1. Method for the horizontal, painting of objects (3) having two prevailing sides, wherein the painting of the first side and the painting of the second side are performed one after the other inside two distinct painting stations (2 ,6), **characterized by the following steps:**

a) Inserting an object (3) to be painted inside a frame (5);
b) The assembly of object (3) and frame (5) is conveyed inside a first painting station (2) so that said object (3) is horizontally painted on its top prevailing side;
c) The assembly of object (3) and frame (5) is conveyed from the first painting station (2) to an overturning device (4) so that the object (3) never touches said conveying means;
d) The assembly of object (3) and frame (5) is turned of 180° inside the overturning device (4);
e) The assembly of object (3) and frame (5) is conveyed to the second painting station (6) so that the object (3) never touches said conveying means;
f) The second prevailing side of the object (3), turned upwards, is horizontally painted inside the second painting station (6)

and the drying of the object takes place only after the two prevailing sides have been painted.

2. Method according to claim 1 in which the overturning is performed inside a housing insulated from the external environment and by forcedly supplying filtered air in said housing.

3. Method for painting of objects (3) having two prevailing sides according to claim 1, wherein the overturning device (4) and/or the conveying device (7) are forcedly supplied with filtered air.

4. Method for painting of objects (3) having two prevailing sides according to claim 1 or 2, wherein the assembly of object (3) and frame (5), after step f), is conveyed to an oven (8) for drying all the paint applied on the door (3).

5. Method for painting of objects (3) having two prevailing sides according to claims 1-3, wherein upstream the first painting station (2) there is provided a loading conveyor (16) of the assembly of object (3) to be painted and frame (5), and a cleaning device (17) for the preventive cleaning of the object (3) to be painted.

6. Method for painting of objects (3) having two prevailing sides according to one of the preceding claims, wherein the two painting stations (2, 6) are chosen from the group consisting in: painting booths making use of oscillating sprayers, painting booths making use of five-axis robot, painting booths making use of anthropomorphic robots, manual painting stations.

7. Method for painting of objects (3) having two prevailing sides according to one of the preceding claims, wherein said two painting stations (2, 6) make use of methods for paint recovery.

8. Method for painting of objects (3) having two prevailing sides according to one of the preceding claims, wherein the objects (3) to be painted are shaped doors.

9. A combination of a support frame (5) and an object having two opposite prevailing sides for carrying out the method according to claim 1 to 8 in which, the said two prevailing sides being at a distance one from the other defining a height of the object,
the said frame comprising at least four member encircling the object around the peripheral sides of the prevailing sides;
the said frame comprising at least two opposite members having an height greater than the height of the object;
means for removably securing the object to the frame impeding relative rotational and translational movements of the object relatively to the frame; the said means securing the object relatively to the height of the frame side members in a position in which the side member protrude over the object heights on the side of each prevailing side of the object;
the head sides of the frame side members forming the bearing surfaces of the frame on a horizontal resting surface, on the side of the frame on each prevailing side of the object.

10. Frame (5) according to claim 9, the said frame being provided in combination with a coating or painting plant, the said coating or painting plant comprising:

- at least a painting station (2) for painting of one of the sides of the object and at least a further painting station (6) for painting the other opposite side of the object with the object being oriented with its prevailing sides in a horizontal position;
- an overturning station between the two painting stations in which the frame with the object are turned of 180°;

the horizontal resting surface for the frame being an object resting surface of at least the two painting stations (2, 6).

11. Frame according to claim 9 or 10 wherein at least two opposed sides of said frame (5) have a height higher than the overall height of the objects (3) to be painted, and preferably the at least two opposed shorter sides (14, 15) of said frame (5) have a height smaller than that of the longer sides (12, 13) of said frame (5).

12. Frame (5) according to claim 11, wherein the two opposed sides (12, 13) having the height higher than the overall height of the objects (3) to be painted, and optionally than the height of the two shorter sides (14, 15), are oriented substantially parallel to the conveying direction of the assembly frame (5) and object (3).

13. Frame according to one or more of the preceding claims 10 to 12 **characterized in that** the overturning station comprises an overturning device (4) for the frame (5) in which an object (3) is secured, wherein said overturning device (4) comprises an overturning actuator and a circuit for supplying filtered, forced air, said overturning being performed inside said housing insulated from the external environment and forcedly supplied with said filtered air.

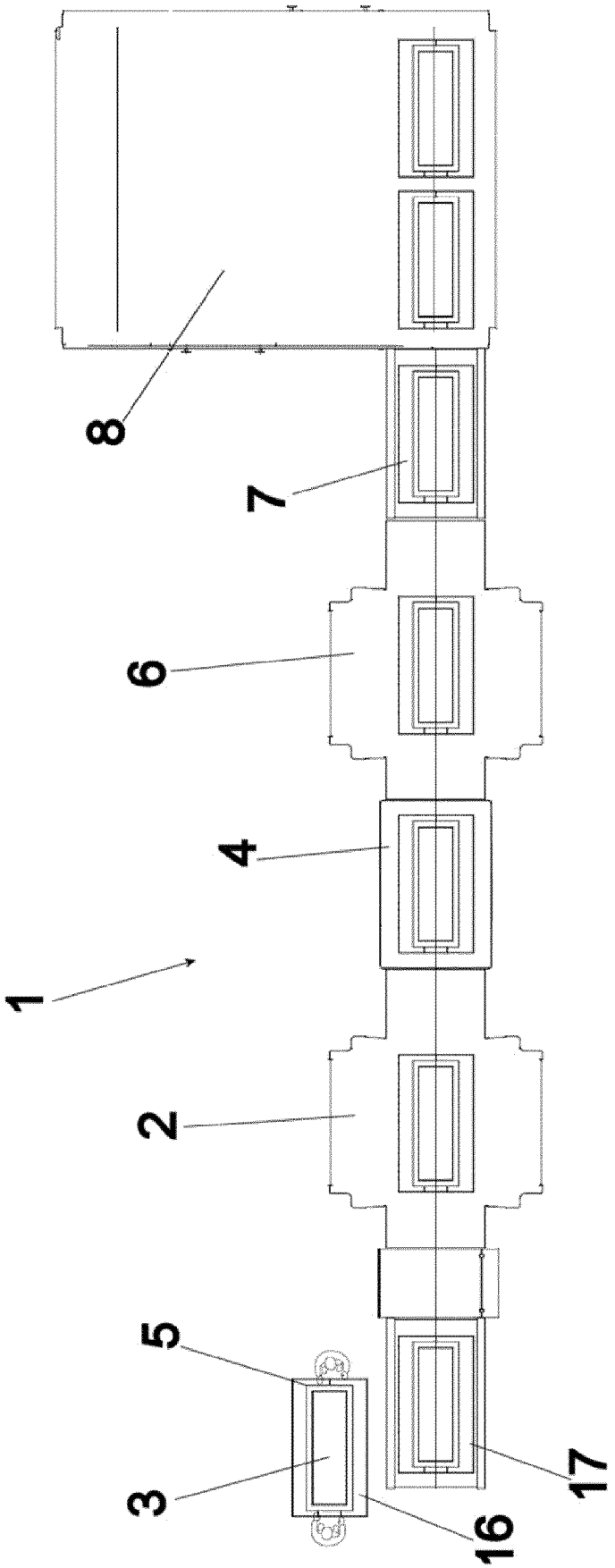

FIG. 1

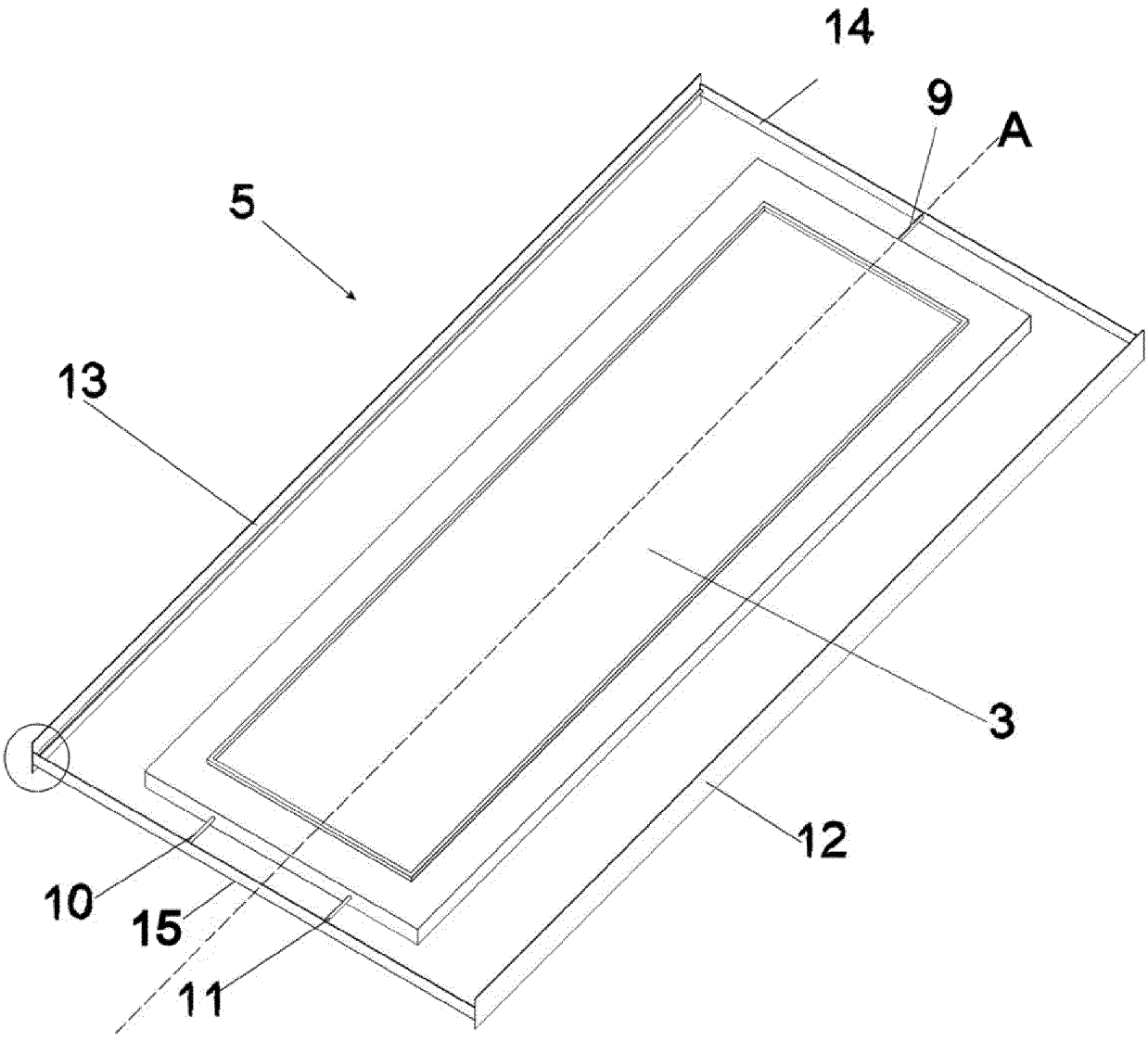

FIG. 2

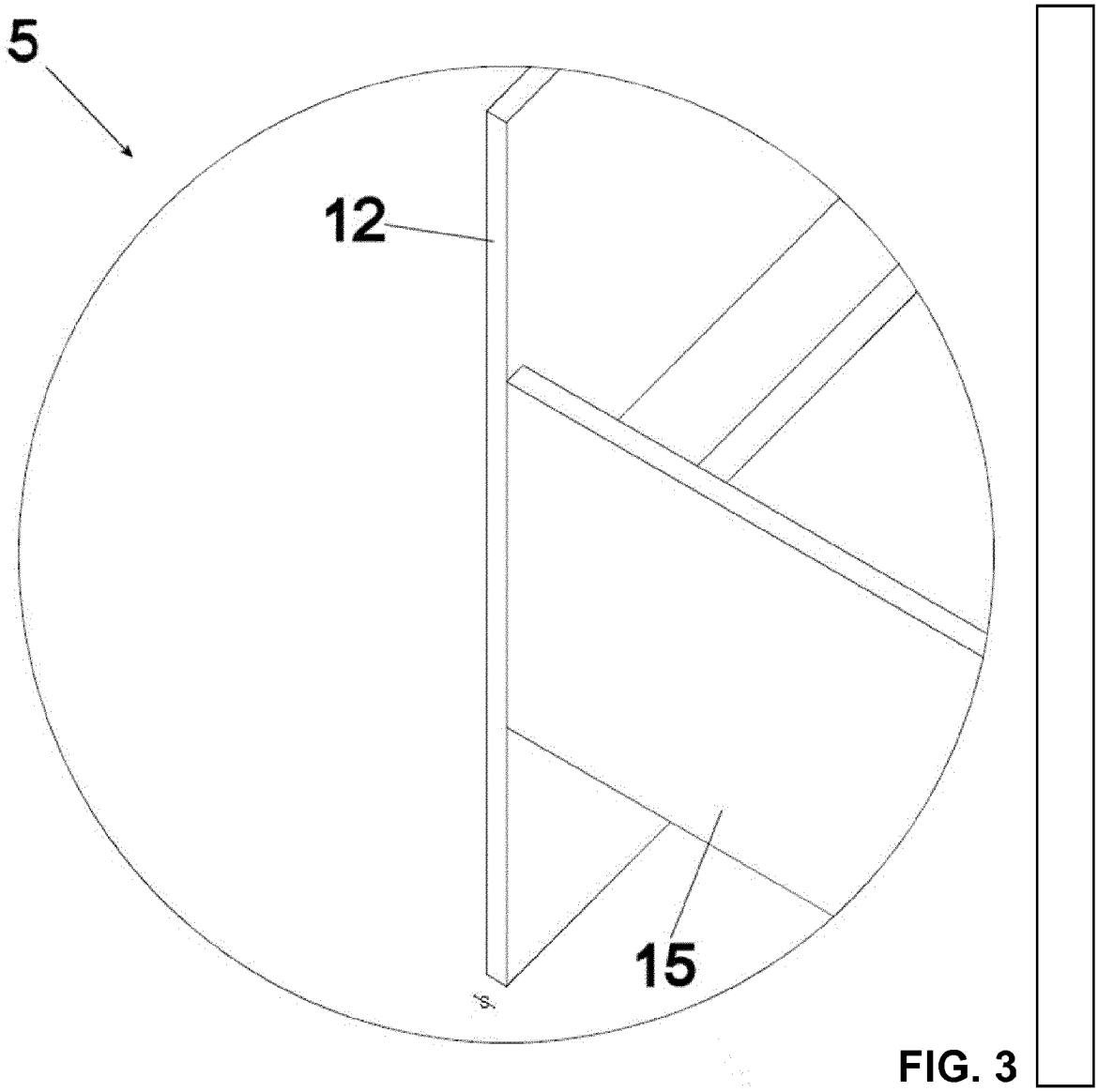

FIG. 3

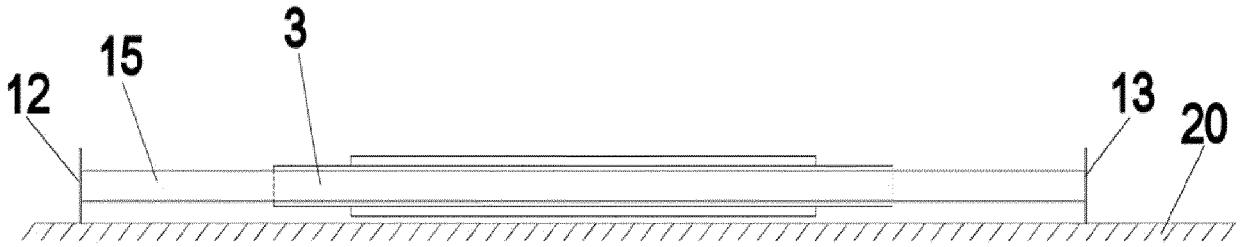

FIG. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 16 20 4814

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 April 2017	Slembrouck, Igor

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EUROPEAN SEARCH REPORT

Application Number
EP 16 20 4814

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